

Electrical Site Planning for Matrix

Abstract

This application note explains how you can prepare for the installation of a Matrix UPS in North America. You will learn what power wiring is needed, and what you will need to do to install the UPS.

Matrix overview

The Matrix UPS comes with a pre-attached flexible input power cord with a NEMA L6-30 type plug. This allows the UPS to be plugged into a standard NEMA L6-30 twist-lock receptacle. The Matrix is equipped with a variety of output receptacles, as described in the product specification sheet. Additional output receptacles of various types may be added at any time by using the Matrix PDU accessory kits. The Matrix can also be "hard wired" directly into your building wiring if you chose to do so.

UPS input voltage requirements

The UPS will operate from virtually any electrical service available in North America. Your building is probably described as having one or more of the following types of power available:

- 208V
- 240V
- 120/240V
- 120V 3-phase
- 208V 3-phase
- 120/208V 3-phase
- 120V
- 240V split phase

Despite the length of this list, there are really only two kinds of power distribution in North America . Standard commercial power is 120V/208V 3-phase. Standard residential power is 120V/240V (some commercial establishments also use 120V/240V). Note that the term "120V" may be used to describe BOTH types of power.

120/208V 3-phase is sometimes described as:

- 120V 3-phase
- 208V
- 208V 3-phase
- 120V

120/240V is sometimes described as:

- 240V
- 120V
- 240V split phase

You need to know which of the two kinds of power you have before you can install Matrix. However, the same Matrix model works with both types of power, so you don't need to worry about input voltage when you order the unit. If your power is only described as "120V", then you need to ask if the power is "120V/208V 3-phase" or "120V/240V". Here is what do when you figure out what kind of power you have:

If you have 120V/208V 3-phase power:

You need to make sure that you have a 30Amp 208V circuit with ground supplying the Matrix. Depending on your situation, you may already have this circuit running to the load to be protected by the UPS. If you do not have an appropriate circuit, you must have the circuit installed by an electrician, who should be directed to install a new 208V circuit from the circuit breaker panel to a NEMA 6-30 receptacle.

If you have some kind of existing circuit that you think might work, you need to figure out if it is compatible with Matrix. You can do this by examining the receptacle and identifying its NEMA type (to help identify NEMA type, see "common questions" below). If you determine that NEMA type is one of the following listed types, you will probably be able to use the existing circuit:

NEMA L6-20 or NEMA 6-20: This circuit only has enough capacity for a 3KVA UPS. If you are installing a 3KVA UPS, you can have the receptacle changed to an L6-30.

NEMA L21-30: This circuit is sometimes called a 120V 3-phase circuit but does not need re-wiring and will work with either a 3 or 5 KVA Matrix, but has more wires than necessary. You should direct the electrician to replace the receptacle with a L6-30. The wiring itself will not need to be changed.

Some sites only have a large number of NEMA 5-15 receptacles nearby (common 120V household receptacles). This might cause you to believe that you could plug the Matrix into a NEMA 5-15 receptacle. However, NEMA-5-15 receptacles cannot handle more than 1.5 KVA and will not work with the Matrix.

If you have 120V/240V power:

You need to make sure that you have a 30A 240V circuit with ground supplying the Matrix. Depending on your situation, you may already have this circuit running to the load to be protected by the UPS. Normally a circuit like this would be furnished with a NEMA L14-30 or L6-30 wall receptacle.

When your Matrix arrives, it will be configured for 208V operation. You will need to reconfigure it for 240V operation. This requires that a rear cover plate be opened and a wire jumper be moved. This operation can be done with a screwdriver and should be performed by a technician or electrician (refer to installation manual).

If you have some kind of existing circuit that you think might work, you need to figure out if it is compatible with Matrix. You can do this by examining the receptacle and identifying its NEMA type (to help identify NEMA type, see "common questions" below). If you determine that NEMA type is one of the following listed types, you will probably be able to use the existing circuit:

NEMA L6-20 or NEMA 6-20: This circuit only has enough capacity for a 3KVA UPS. If you are installing a 3KVA UPS, you can have the receptacle changed to an L6-30.

NEMA L14-30: This circuit does not need re-wiring and will work with either a 3 or 5 KVA Matrix, but has more wires than necessary. You should direct the electrician to replace the receptacle with a L6-30.

Some sites only have a large number of NEMA 5-15 receptacles nearby (common 120V household receptacles). This might cause you to believe that you could plug the Matrix into a NEMA 5-15 receptacle. However, NEMA-5-15 receptacles cannot handle more than 1.5 KVA and will not work with the Matrix.

UPS output wiring compatibility

Most Matrix users have equipment that plugs into standard receptacles. It is important to consider the type, quantity, and location of required UPS-protected receptacles.

The Matrix comes standard with a variety of common receptacles. If your equipment is adjacent to the Matrix and the Matrix receptacles are adequate in number and quantity, then installation will be simple. Otherwise, you will have one of the following situations:

Not enough receptacles on Matrix: More receptacles can be gained by using one of the Matrix PDU (Power Distribution Unit) accessories. Various combinations of receptacles are available; see product information.

Incorrect type of receptacles on Matrix: The Matrix PDU accessories offer a plug-in selection of various combinations of receptacles, see product information. Note that some of the PDU options can be used in combination to further add to the available receptacles. If you still cannot find the receptacle combination you are looking for you should consult the factory or hard-wire the UPS.

Power cords can't reach to Matrix: If your equipment can't be moved close enough to Matrix to reach the receptacles, you can get 4 feet of additional range using one of the Matrix PDU accessories. Extension cords may be used to extend the output range of Matrix, but their use may be regulated by local building codes. If you want to distribute receptacles over an office or wiring room, you may be required by local code to "hard-wire" the output of the UPS using standard "in the wall" or conduit building wiring.

Plug-in vs. Hard Wire

The best way to install Matrix is to plug into a standard NEMA L6-30 connector. This connector is very reliable and difficult to accidentally dislodge. Plug-in makes installation easy and it is simple to ever move the unit if necessary. However, there are conditions where hardwiring is useful or necessary.

Normally it is not necessary to hard wire the output of the UPS. If you need to hard wire the output due to code restrictions or the need for combinations of receptacles not offered by APC, you should consult with an electrician and order a hard-wire kit for the Matrix. Please note that if you intend to hard-wire the output of the UPS, the U.S. National Electrical Code requires that you hard-wire the input.

Common Questions:

Why can't I just plug the Matrix into a standard 120V receptacle?

The standard 120V receptacle is only rated for 1500VA and cannot handle the load of the Matrix without overheating. It is a violation of UL and the National Electrical code to plug the Matrix into a standard 120V receptacle.

Can I hardwire the Matrix input to a 120V circuit?

All 120V systems are either 120V/240V or 120V/208V 3-phase. Therefore there is always either 208V or 240V available in a 120V system. You must use the 208V or 240V wiring in your 120V system. The Matrix uses the higher voltage so that it can use lower current and standard plugs and receptacles. If the Matrix 5000 was wired to the 120V part of the circuit, it would need 60Amp wiring, connectors, and breakers which are quite uncommon. This would raise installation costs considerably.

I have a big AC power receptacle; how can I tell what NEMA type it is?

Some power receptacles are marked on the face as to the NEMA type. Many receptacles only have voltage and current ratings on them (example: " 120V 30 A"). Here is the key to determining the NEMA type:

- If it has curved slots arranged in a circle, the NEMA type begins with "L" (locking)
- If it has 3 slots and is rated at 125V, it is a type "5"
- If it has 3 slots and is rated at 250V, it is a type "6"
- If it has 5 slots one of which is a center hole it is a type "21"
- If it has 4 slots and is rated at 125/250V, it is a type "14"
- If it has 4 slots and is rated at 250V, it is a type "15"

The current rating is the last two digits of the NEMA type

Therefore, a plug marked "250V 20A" with 3 uncurved slots is a NEMA 6-20. A plug marked "125V 30A" with 3 curved slots is a NEMA L5-30.

I have more than 1.5KVA of equipment all plugged into NEMA 5-15 receptacles; how is this possible if the NEMA 5-15 can only handle 1.5KVA?

One of the following situations applies to you: Either A) your NEMA 5-15 receptacles are really all completely separate 1.5KVA circuits and you have not overloaded any single circuit, B) you have a serious overload condition, or C) your load is less than you think.

Can I connect extension cords to the output of Matrix?

The Matrix will operate perfectly with output extension cords. However, the use of extension cords is regulated by local building codes. In fact, some cities such as New York and Chicago specifically forbid the use of extension cords except for temporary maintenance. In these cities a computer installation is not considered temporary. Some companies have even been ordered to remove all of their extension cords and cord-connected surge strips.

Matrix PDU accessories can provide an extra few feet of code compliant "extension cord". Unfortunately, code restrictions force APC to only offer the PDU accessories with a 4-foot cord.